Chapter 4
Existing and Future Conditions

The "state of the town" from a transportation perspective can be characterized by the word "expanding". Examples of how streets and services are expanding range from new bus service in town to road widening, trail building and safer routes to schools. The following description of existing conditions is organized by mode of travel.

Walking

Wake Forest is situated among gently rolling hills and moderately forested land. There are pleasant places to walk in Wake Forest. Most residents enjoy the small town quality of life, while still having convenient access to downtown Raleigh and the Research Triangle Park. The central core of Wake Forest is the downtown business district, which contains an array of local businesses, homes and the campus of the Southeastern Baptist Theological Seminary. This quaint area of town is filled with tree-lined streets and historic buildings dating to the 19th century.

The *Wake Forest Pedestrian Plan* (adopted 2006) cites more than one dozen neighborhoods that are not conveniently connected by continuous sidewalk with downtown Wake Forest. Neighborhoods and schools are the types of places most often identified as walking destinations. Wake Forest Elementary School participates in the national Walk to School Day in October each year. The town is seeking federal funds to expand sidewalks serving all public schools. Typically, Wake Forest spends at least $100,000 of local funds each year to build sidewalks, not including the cost of building sidewalks when new roads are built or widened. It is much more efficient to build sidewalks as a part of a road construction or land development project.

The Town has a limited system of existing paved greenways (trails) but with aggressive plans to pave more and expand the system. **Figure 2.2** in **Chapter 2** shows the location of priority pedestrian corridors in Wake Forest. Eight public schools are located in Wake Forest, as listed in **Table 4.1**. The availability of sidewalks to each school varies by location.

Various ordinances, maps, and adopted plans are available on the Town's website (www.wakeforestgov.com). These documents include additional information about existing and future pedestrian conditions as presented in the *Wake Forest Pedestrian Plan* and the *2009 Open Space and Greenway Plan Update*.

Table 4.1 – Existing and Planned Sidewalks near Schools

School	Existing Sidewalks		Planned Sidewalks
	Primary Entrance	Secondary Entrances	Priority Corridors Planned?
Dubois Campus / Forest Pines	North Allen Rd (sidewalk both sides)	N Franklin St E Cedar Ave (no sidewalk on either street)	No
Jones Dairy Elementary School	Jones Dairy Rd (no sidewalk)	Winter Spring Dr (sidewalk east side)	Jones Dairy Rd -No Ridgemont Rd - Yes Jones Farm Rd – Yes
Heritage Elementary School	Rogers Rd (school frontage only; no connections)	S Franklin St (no sidewalk, but Holding Village will build partial)	S Franklin St – No Rogers Rd – Yes
Heritage Middle School	Rogers Rd (school frontage only; no connections)	S Franklin St (no sidewalk, but Holding Village will build partial)	S. Franklin – No Rogers Rd – Yes
Heritage High School	Forestville Rd (no sidewalks)	Rogers Rd (no sidewalk)	Rogers Rd – Yes Forestville Rd – No Greenway planned on west side of HS
Wake Forest Elementary School	S Main St (sidewalk both sides)	W Sycamore Ave (sidewalk both sides) S Wingate St (no sidewalk)	S. Wingate St – Yes
Wake Forest-Rolesville Middle School	West side of S Main St (sidewalk on west side)	Rogers Rd (short sections of sidewalk that do not connect)	Rogers Rd – Yes
Wake Forest-Rolesville High School	Stadium Dr	N Rock Springs Rd (sidewalk one side)	Stadium Dr – Yes N Rock Springs Rd – No

Bicycling

North Carolina state law considers bicycles as vehicles and therefore lawful for cyclists to ride on any public road unless it is designated as a limited or controlled-access highway. However, some roads are more suitable than others. A survey of 193 residents conducted in February 2007 for the *Wake Forest Bicycle Plan* reported road ratings shown in **Table 4.2**.

Table 4.2 – Roads Rated by Bicyclists

	Posted Speed Limit	2007 Traffic Volume	Travel Lanes (Width)
Roads rated as "safe and frequently used for cycling"			
Averette Road	45 mph	1,400	2 (21')
Oak Grove Church Road	35 mph	900	2 (21')
North Main Street	35-45 mph	5,700	2 (53')*
Harris Road	45 mph	2,400	2 (21')
Purnell Road	45 mph	4,500	2 (22')
Thompson Mill Road	45 mph	4,800	2 (21')
Roads rated as "uncomfortable for cycling"			
Ligon Mill Road	45 mph	7,000	2 (21')
North White Street	35-45 mph	3,600	2 (21')
Durham Road	35-45 mph	8,700	Primarily 2 (24')
Falls of Neuse Road, north of Wakefield Plantation Drive	45 mph	11,000	3 (est. 36')

Source: *Wake Forest Bicycle Plan* (August 2008). A questionnaire was completed by 193 residents who responded online or at a public meeting.

* North Main Street from North Avenue to just south of Oak Avenue has two travel lanes, a wide raised-curb median, and on-street parking on both sides of the street.

Higher cycling skill levels are expected on South Main Street, Durham Road, and Burlington Mills Road. By observation, it is surmised that a significant proportion of current bicycle ridership occurs on lower-speed residential neighborhood streets rather than major thoroughfares in Wake Forest. Ordinances prohibit bicycling on sidewalks in Wake Forest. Transportation safety research shows that riding bicycles on sidewalks is up to twenty-five times less safe than riding on a major street that has no bike lanes. The research also shows that adding bike lanes on major streets improves safety.

"Motorists think I'm in their way, but I can only get over so far before I feel scared."

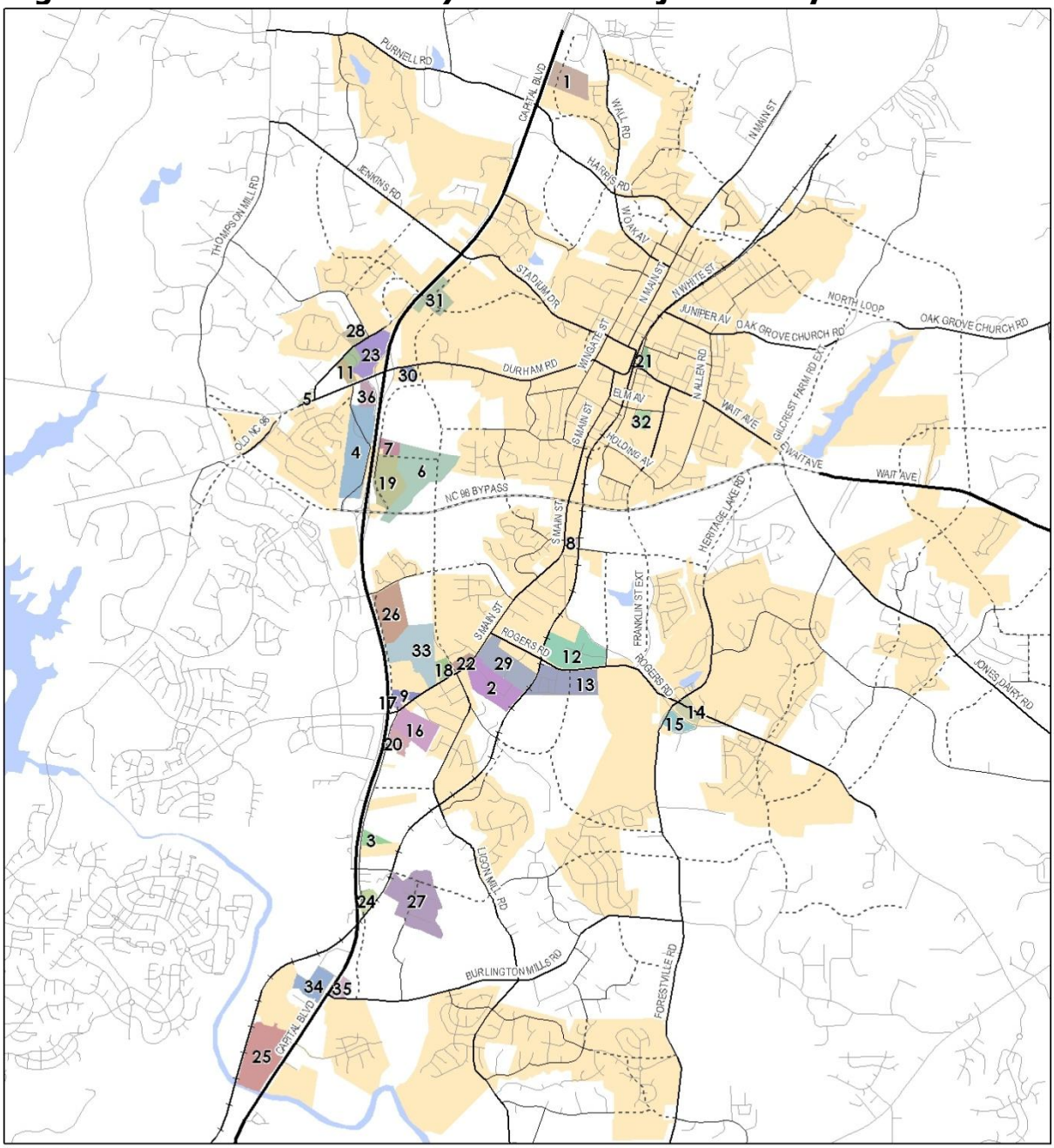
"Wake Forest would be an ideal town if there were more places to ride on the roads."

Activity centers are where shopping centers, downtown commercial areas, and community places such as libraries are clustered together. In Wake Forest, much of the shopping is located along South Main Street and Capital Boulevard (US 1). Bicycling to these locations will be improved when slower-speed collector streets are built to and within these activity centers. **Figure 4.1** shows the location and listing of major activity centers in Wake Forest.

Additional information about bicycling is presented in the *Wake Forest Bicycle Plan* available at:

www.wakeforestnc.gov/client_resources/residents/planning/bike_plan_executive_summary.pdf

Figure 4.1 – *Wake Forest Bicycle Plan* – Major Activity Centers



Legend

1. Capital Blvd. Business Center
2. Capital Commerce Center
3. Capital Pines
4. Capital Plaza
5. Crenshaw Pointe
6. Crenshaw Village
7. Crescente Pointe
8. Friendship Chapel Center
9. Golden Corral
10. Hampton Commons
11. Hampton Park
12. Heritage Business Park
13. Heritage Commons
14. Heritage Square
15. Heritage Station Shopping Center
16. Leith Chevrolet & Dodge
17. Leith Kia
18. Ligon Mill Business Center
19. Lowe's Home Improvement
20. Luck Stone
21. Lyon Shopping Center
22. Main Street Station
23. Market of Wake Forest
24. North Wake Business Center
25. Riverplace Commerce Center
26. Shoppes at Caveness
27. South Forest Business Park
28. Tarlton Park Office Center
29. The Factory
30. Wake Forest Business Park
31. Wake Forest Crossing Shopping Center
32. Wake Forest Plaza Shopping Center
33. Wake Pointe Shopping Center
34. Wakefield Ford
35. Wakefield Junction
36. Winn-Dixie Plaza

Future Road
Local Streets
Railroads
Lakes
Town Limits

N

0 0.25 0.5 1 1.5 2 Miles

Source: Town of Wake Forest Bicycle Plan, August 2008

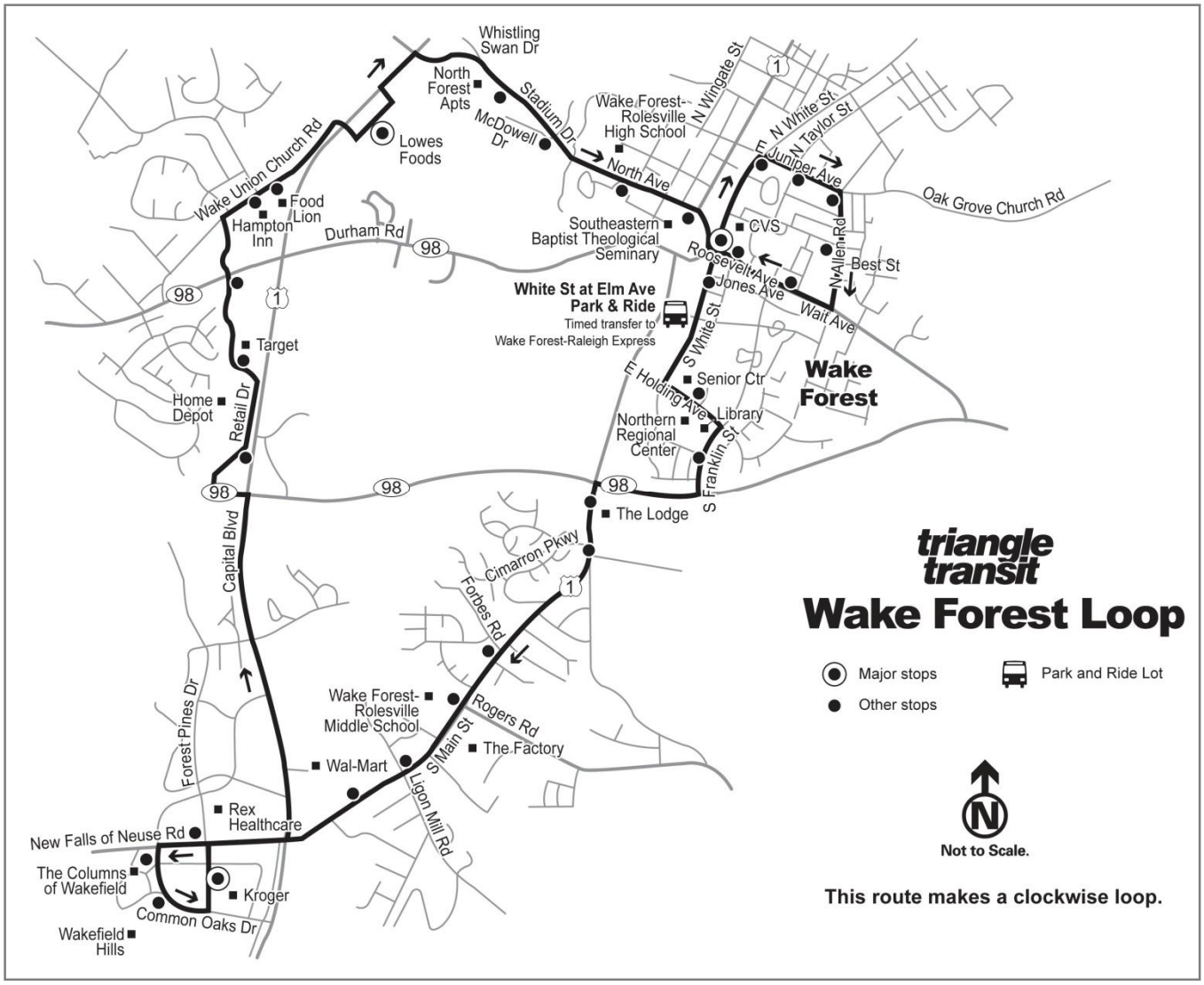
Bus Riding

Two public bus routes serving Wake Forest launched in November 2008, as illustrated in **Figure 4.2a** and **Figure 4.2b**. The "Loop" route circulates clockwise around town, completing one loop in about 50 minutes with a vehicle smaller than a standard city bus. Service runs from 6 am to 8 pm weekdays. Many major community facilities are served with nearly 30 stops along the way including the library, senior center, post office, Wake County Northern Regional Center, Wal-Mart, historic downtown business district, apartments, Southeastern Baptist Seminary, Wake Forest-Rolesville High School, other public and private schools, and hundreds of businesses including several grocery stores. Perhaps the most important bus stop is downtown on South White Street south of Elm Avenue where there is a park-and-ride lot and a bus stop for the "Loop" and the Wake Forest Express (WFX) bus to Triangle Town Center Mall or downtown Raleigh.

The WFX bus route connects downtown Wake Forest with the Orvis parking lot at Triangle Town Center shopping mall and the Moore Square Transit Station in downtown Raleigh. The ride to the mall takes about 25 minutes each way. Riders must transfer to another bus (CAT Route 1) for the trip to downtown Raleigh. A full hour is scheduled each way between downtown Wake Forest and downtown Raleigh. The round-trip fare is $4, increasing to $5 during peak periods. Service is from 5 a.m. to 8 p.m. weekdays only.

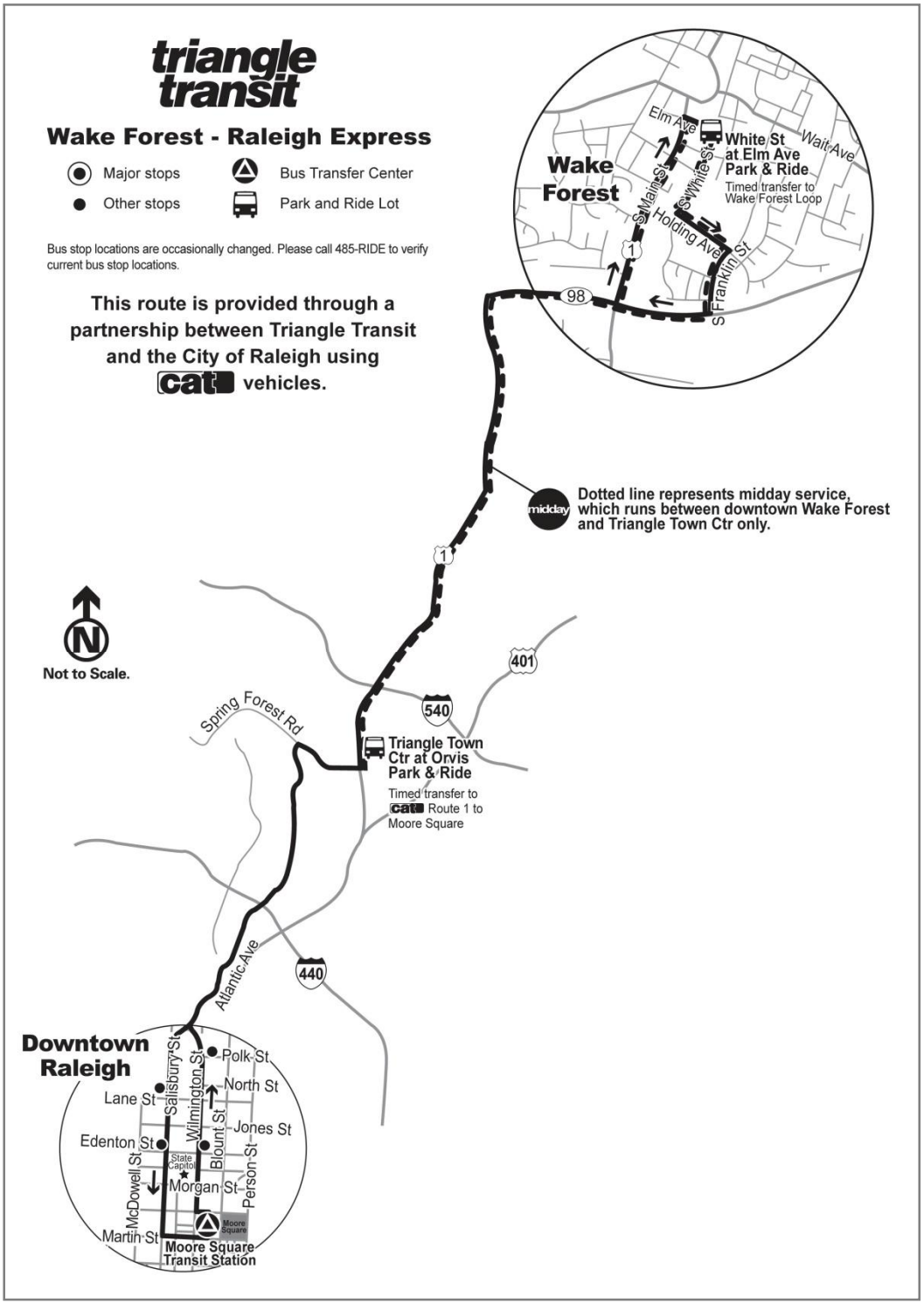
Both bus routes run on a schedule and stay along a fixed route. The fare is free on the "Loop". Both routes are operated by Raleigh's CAT system under an operating agreement with the City of Raleigh, the Town of Wake Forest, and Triangle Transit.

Figure 4.2a – Wake Forest Loop Map



Source: **http://www.wakeforestnc.gov/client_resources/residents/wake%20forest%20loop%20draft%20brochure.pdf**

Figure 4.2b – Wake Forest - Raleigh Express Map



Source: http://triangletransit.org/uploads/bus_pdfs/WFX_1-4-10.pdf

Driving

As the region's economy expands and more and more permanent residents relocate to the area, the frequency and length of trips on the current system of highways and streets in Wake Forest can be expected to increase. This increase in traffic volume will create new deficiencies on the existing transportation network. Traffic bottlenecks may become evident in places that currently function adequately and existing deficiencies will be magnified. Prior to anticipating future traffic problems, it is helpful to gain an understanding of the existing conditions of driving in Wake Forest. This discussion includes Corridors and Activity Centers, Functional Classification, Corridor Operations, and Traffic Safety and Crash History. The section concludes with a brief description of future traffic conditions.

Corridors and Activity Centers

As development occurs and more vehicles take to the road, roadway improvements are needed to reduce traffic congestion. These roadway improvements often enhance access, thus raising land values and attracting more development. The interaction between activity centers and the transportation corridors that link them to other centers is important, as are the mobility choices provided within the center. Often neighborhoods and activity centers rely on a small number of transportation corridors to provide essential links between home, school, employment, shopping, social, and recreational destinations. The extent to which these origins and destinations blend into multi-purpose activity centers has a dramatic effect on a person's ability to choose between modes for their trip. In many cases, the range of trip alternatives (walk, bike, drive, or transit) also can influence the overall perception of a community.

Downtown Wake Forest is an example of a well-connected activity center. Many streets connect to and through the area. Crossings of the railroad at Roosevelt Avenue, Elm Avenue, and Holding Avenue are critical to the success of downtown, precisely because of the connectivity. The choice in routes allows people to walk or bicycle to and within the downtown area, and the restraint shown in avoiding overly wide streets contributes to the walkability of downtown Wake Forest. The recent location of a major bus hub on South White Street provides additional multimodal choices for living, working, shopping, and playing in downtown Wake Forest.

On-street parking often is discussed in activity centers including downtown Wake Forest. A recent presentation in Raleigh by Dr. Donald Shoup highlighted the following three basic principles from his book "The High Cost of Free Parking".

1. The supply and price of on-street parking should be set and managed with the goal of inducing turnover (one vehicle departs, another arrives to fill the vacant parking spot) that is high enough so that at at the peak parking demand period no less than 15 percent of parking spaces are available. This results in an available spot every 7 parking spaces; thus appearing customer friendly.

2. The price of on-street parking (meters) should be set at the same or higher rate as the nearest available public parking garage. On-street spaces are prime in terms of location and typical customer preference, so the price should reflect the higher preference. Parking garage rates are often set based on the revenue return needed to pay off debt service incurred by the owner during construction. This rate should influence the rate charged for nearby on-street parking.

3. On-street parking in residential neighborhoods that are walking distance to activity centers are a public asset. Residential parking permit programs should be used for nighttime parking, but daytime use should produce revenue for the local agency with a portion of the proceeds returned to the neighborhood in the form of public realm (streetscape, parks, etc.) improvements or maintenance (litter clean-up, additional security patrols).

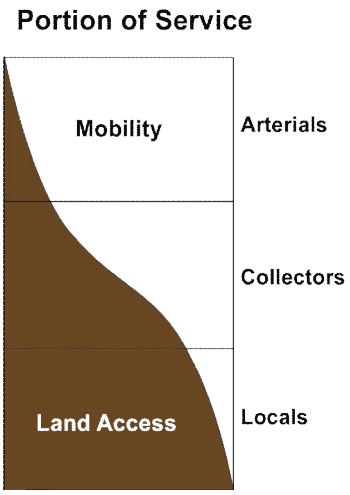
The level of success for corridors within and between activity centers depends in large part on the intended function of the street. A unique challenge for the future will be to balance the Town's mobility needs with other priorities. Often traffic mobility has taken priority without regard for other considerations such as the function of the street, corridor relationship to land use, urban design, and the promotion of alternate modes.

A unique challenge in creating a successful transportation system for the Town is blending connectivity and access functions while preserving the small town charm and unique character of Wake Forest. Neighborhoods and activity centers throughout the Town may have different needs and priorities. While recognizing these differences, it is important not to lose focus of the practical concept of overall connectivity. This concept is particularly relevant as it relates to people's desires to make safe and efficient trips not only by driving, but also by walking, bicycling, or using public transportation. For this reason, the recommendations detailed in **Chapter 5** include enhancements to the pedestrian, bicycle, transit, and roadway networks.

Functional Classification

The classification of streets into several "functional" categories aids in communication among policy makers, planners, engineers, and citizens for expanding the transportation system. The functional classification system groups streets according to the land use served (or to be served) and provides a general designation of the type of traffic each street is intended to serve. The street functional classification system primarily defines the street in terms of roadway design and character as well as operational features for the movement of vehicles.

Two major considerations that distinguish thoroughfares from neighborhood streets are access and mobility. The primary function of local or neighborhood streets is to provide access. These streets are intended to serve localized areas or neighborhoods, including local commercial land uses and mixed-use areas (i.e. low speeds, low volumes, and short distances). Local streets are not intended for use by through traffic. The primary function of thoroughfares is mobility. Limiting access points (intersections and driveways) on thoroughfares enhances mobility. Too much mobility at high speeds limits access by pedestrians and bicyclists. The thoroughfare is designed to carry more traffic than is generated within its corridor (i.e. higher speeds, higher volumes, and longer distances). The existing public street network in Wake Forest uses the NCDOT thoroughfare classification system including freeways, expressways, boulevards, other major thoroughfares, and minor thoroughfares. The NCDOT system also includes collectors and local streets. Each type is described below.



Thoroughfares

Thoroughfares provide high mobility, operate at higher speeds (45 mph and above), provide significant roadway capacity, have a great degree of access control, and serve longer distance travel. These facilities can be subdivided into categories that include facilities with full access control such as freeways and expressways, as well as major and minor thoroughfares. They usually connect to one another or to collector streets and very few connect to local streets.

Expressways and Freeways

Expressways and freeways provide the most mobility and least access (since access is only available at interchanges). Expressway/freeway facilities typically serve longer distance travel and support regional mobility. The state funds roadway improvement and maintenance on these facilities. I-540 is an example of a freeway.

Boulevards

Boulevards provide a moderate level of mobility for traffic traveling at medium speeds. Access is managed including the use of medians and shared-access driveways by adjacent parcels of land. Driveways mostly are right-in/right-out only. A mix of intersections and interchanges may exist. Multi-modal elements include bus stops, bicycle lanes (urban) or wide paved shoulders (rural) and sidewalks (urban).

Capital Boulevard (US 1)

Major Thoroughfares

Major thoroughfares typically have tightly controlled access and few, if any, individual site driveways. These facilities serve medium to longer distance travel and typically connect minor thoroughfares and collector streets to freeways and other higher type roadway facilities. Generally, roadway improvements and maintenance on major thoroughfares are funded by the state, but it typically takes more than a decade to secure the necessary funding. Major thoroughfares in Wake Forest include Capital Blvd (US 1).

Minor Thoroughfares

Minor thoroughfares primarily serve a mobility function but often have more closely spaced intersections, some individual site driveways, and generally lower design and posted speeds compared to other thoroughfares. The minor thoroughfare network primarily serves local traffic and connects to other minor thoroughfares, major thoroughfares, and collector streets. Minor thoroughfares provide a higher level of access to adjacent land uses than major thoroughfares and typically have lower traffic volumes. For the most part, minor thoroughfares are maintained by the state but the cost may be the responsibility of local governments. These roads typically are widened at developer or municipality's cost.

In general, minor thoroughfares in the study area have two-lane undivided cross sections with little or no paved shoulders and an occasional left-turn lane at intersections and major driveways. Posted speed limits range from 35 mph to 45 mph. White Street, Elm Avenue, and Holding Avenue are examples of a minor thoroughfares in Wake Forest.

North White Street

Collectors

Commercial Collector Street

Collectors typically provide less overall mobility, operate at lower speeds (less than 35 mph), have more frequent and greater land use access flexibility, and serve shorter distance travel than arterials. Collectors provide critical connections in the roadway network by bridging the gap between thoroughfares and locals. Thus, the majority of collector streets connect with one another, with local streets, and with minor thoroughfares.

The primary purpose of the collector street system is to collect traffic from neighborhoods and distribute it to the system of major and minor thoroughfares. In general, collector streets have two lanes and often have exclusive left-turn lanes at intersections with major and minor thoroughfares and less frequently at intersections with other collector streets. While many existing collector streets in Wake Forest are state owned and maintained, new collector streets are rarely constructed and funded by the state. Responsibility for collector streets usually falls to the local government and the development community for funding, design, and construction. As a result, these streets often are built by developers in conjunction with land planning and development of private property.

Wake Forest has maintained a collector street plan since the mid-1990's, updating it periodically and implementing it wherever practical. The community benefits from spacing of connected streets (collectors and thoroughfares) every quarter-mile on average. New roads must adhere to the physical terrain and minimize or avoid human and environmental impact, so the quarter-mile guideline should be adjusted accordingly but not ignored. Existing collector streets in Wake Forest include Heritage Club Avenue, Wingate Street, and Cimarron Parkway.

Locals

Local facilities provide greater access and the least amount of mobility. These facilities typically connect to one another or to collector streets and provide a high level of access to adjacent land uses/development (i.e., frequent driveways). Locals serve short distance travel and have low posted speed limits (25 mph to 35 mph). Most roadways in Wake Forest are classified as locals. These warrant infrequent repaving and, if necessary, sidewalk construction.

Corridor Operations

US 1 / Dr. Calvin Jones Highway Interchange *(source: Bing.com)*

Regional Mobility

Regional mobility in the Wake Forest area is provided by three major thoroughfares — US 1 (Capital Boulevard), NC 98, and US 401 (Louisburg Road). Capital Boulevard (US 1) is a primary north/south corridor for the Triangle. Through Wake Forest, it is a four-lane divided highway with a mixture of unsignalized and signalized intersections, including interchanges at NC 98 and Dr. Calvin Jones Highway (NC 98 Bypass). The posted speed limit on Capital Boulevard throughout the study area is 55 mph.

NC 98 is a four-lane major thoroughfare that runs east/west and passes south of downtown Wake Forest on its way between Nash County and Durham. US 401 (Louisburg Road) is a rural two-lane highway with posted speeds of up to 55 mph that runs along the southeastern edge of Wake Forest's ETJ. US 401 is a popular route for commuters traveling to Raleigh.

Congested Corridors

Congested corridors result from several factors (often because of bottlenecks located primarily at intersections) along the corridor. Aside from individual bottleneck locations in corridors, congestion frequently results from too many people trying to use a route that already operates at or over-capacity. Motorists generally do not have the option to take alternative corridors.

Traffic Volumes

Traffic volumes signify the total number of vehicles traveling along a roadway segment on an average day. **Figure 4.3** illustrates 2007 average daily traffic (ADT) volumes in Wake Forest as provided by NCDOT. The road carrying the highest traffic volume in the study area in 2007 was Capital Boulevard (US 1) ranging from 34,000 vehicles per day (vpd) at the Franklin County line to 63,000 vpd near Durant Road / Perry Creek Road. Other roads with high traffic volumes in 2007 are listed in **Table 4.3**. **Table 4.4** compares traffic volumes in 2007 with volumes on the same segments in 1997-1999.

Table 4.3 – Roads with Highest Traffic Counts in 2007

Road	Location	2007 AADT*
Capital Blvd (US 1)	North of Durant Rd / Perry Creek Rd	63,000
US 401	North of Perry Creek Rd	40,000
Capital Blvd (US 1)	Franklin / Wake county line	34,000
S Main St (US 1A)	North of Capital Blvd	25,000
Falls of Neuse Rd	North of Neuse River bridge	20,000
Durham Rd	West of Capital Blvd	17,000
Burlington Mills Rd	East of Capital Blvd	11,000
Dr. Calvin Jones Highway	West of Wait Ave / Jones Dairy Rd	11,000^

* 2007 Average Annual Daily Traffic Volume (vehicles per day)
^ estimated from peak hour count

Table 4.4 – Largest Change in Traffic Volume, 1997 to 2007

Road	Location	1997-1999 AADT	2007 AADT*	Percent Change
Capital Blvd (US 1)	Harris Rd to Stadium Dr	26,000 ('99)	45,000	Increased 73%
Capital Blvd (US 1)	South of S Main St	32,000	46,000	Increased 44%
S Main St (US 1A)	US 1 to Ligon Mill Rd	11,000	25,000	Increased 127%
Roosevelt Ave	White St to Franklin St	13,000	6,500	Decreased 50%
Ligon Mill Rd	South of S Main St	1,900	7,000	Increased 268%

* 2007 counts conducted prior to opening Dr. Calvin Jones Highway between Capital Blvd and S Main St

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See Figure 4.3 – 2007 AADT on previous page.

Volume-to-Capacity Ratios

However, traffic volumes alone should not be used to determine congested corridors because this measurement does not take into account different functional classifications and roadway capacity. A better measurement for this comparison is volume-to-capacity (V/C) ratios. V/C ratios are calculated by dividing the traffic volume of a roadway segment by the theoretical capacity of the roadway. The result is a universal measurement.

These ratios can be compared to roadway Level of Service (LOS), which places roadways into six letter grade levels of the quality of service to a typical traveler on a facility. An "A" describes the highest level (least congestion) and level "F" describes the lowest level (most congestion). The Levels of Service (and V/C ratios) shown in **Figure 4.4** are grouped into one of the following categories. The level of service analysis for this plan was based on the Triangle Regional Model, which is administered by the Institute for Transportation Research and Education (ITRE). The Levels of Service (and V/C ratios) shown in the figure are grouped into one of the following categories.

- **LOS A or B** — *Well Below Capacity* (V/C = less than 0.8) — Roadways operating with a V/C ratios less than 0.8 operate at optimal efficiency with no congestion during peak travel periods. These corridors are not shown in the congested corridors map due to the relative ease of travel during most time periods.
- **LOS C** — *Approaching Capacity* (V/C = 0.8 to 1.0) — As the V/C nears 1.0, the roadway becomes more congested. A roadway approaching capacity may operate effectively during non-peak hours, but may be congested during morning and evening peak travel periods.
- **LOS D or E** — *At or Slightly Over Capacity* (V/C = 1.0 to 1.2) — Roadways operating at capacity are somewhat congested during non-peak periods, with congestion building during peak periods. A change in capacity due to incidents impacts the travel flow on corridors operating within this V/C range. On the upper end of this category, corridors experience heavy congestion during peak periods and moderate congestion during non-peak periods. Changes in capacity can have major impacts on corridors and may create gridlock conditions.
- **LOS F** — *Well Over Capacity* (V/C = greater than 1.2) — Roadways in this category represent the most congested corridors in the study area. These roadways are congested during non-peak hours and most likely operate in stop-and-go gridlock conditions during the morning and evening peak travel periods.

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See Figure 4.4 – Congested Corridors on previous page.

Throughout the Triangle, rapid growth has made it difficult if not impossible for local decision-makers to construct enough road lanes to handle increases in traffic. The result is peak hour traffic congestion on several major area roadways. Although the commute between Wake Forest and Raleigh via Capital Boulevard (US 1) typically is congested, traveling around Wake Forest normally can take place at the posted speed limit. Delay occurs due to left-turning vehicles where no left-turn lanes exist and bus stops with insufficient space for vehicles to pass a stopped bus. Delays continue to occur near the Southeastern Baptist Seminary, particularly on Front Street and Roosevelt Avenue, however the time delay decreased when Dr. Calvin Jones Highway opened to traffic east of Capital Boulevard.

Congested corridors were mapped in the Wake Forest Transportation Plan (adopted 2003) including:

- Capital Boulevard (US 1) between Durant Road / Perry Creek Road and South Main Street
- South Main Street (US 1A) between Capital Boulevard and South Avenue
- Roosevelt Avenue / Wait Avenue (NC 98 then) between Jones Dairy Road and Franklin Street
- Front Street between North Avenue and South Avenue
- North Avenue between Front Street and Rock Springs Road
- Stadium Drive between Rock Springs Road and Capital Boulevard
- Durham Road (NC 98 then) between Tyler Run Drive and South Main Street
- Durham Road (NC 98 then) between Capital Boulevard and Wake Union Church Road
- Falls of Neuse Road between Garden Hill Drive and Wakefield Plantation Drive
- Burlington Mills Road between Ligon Mill Road and US 401

There were four congested intersections all of which were located along the roadways listed above. Conditions on the old NC 98 route (Wait Avenue / Roosevelt Avenue / Front Street / South Street / Durham Road) have improved considerably. It is estimated that more than 6,000 vehicles per day have diverted to other routes, mostly to Dr. Calvin Jones Highway. Congested corridors in 2005 indicate that Capital Boulevard, South Main Street, and a segment of Durham Road continue to experience peak hour congestion.

Traffic Safety and Crash History

Traffic safety is a key component to any successful transportation plan. Examining the crash history and traffic patterns usually can predict locations where improvements in traffic safety will benefit both motorists and the community as a whole. A traditional approach to determining locations for safety countermeasures involves studying the number and type of crashes in a location as well as the associated crash rate for the location.

NCDOT maintains a database of reported crashes statewide. The summary of crash data shown in the table represents reported crashes at specified locations in Wake Forest from October 1, 2005 through September 30, 2008. The crashes are ranked by Equivalent Property Damage Only Rate, which represents a measure of severity. The worst-case crash locations in Wake Forest are shown in **Table 4.5**. These locations also are identified in **Figure 4.5**. The top five crash locations in terms of frequency are shown in **Table 4.6**. This table also lists the most frequent crash type at each intersection.

Contributing factors to a location's high crash frequency include intersection design, access considerations, and traffic congestion. Many of the locations identified with high crash frequency were also locations where congestion often exists. A direct relationship exists between traffic congestion and crash frequency, which justifies the ongoing efforts to provide adequate funding for transportation projects that minimize traffic congestion. Driveway access in proximity to intersections can also contribute to crash frequency by increasing the unexpected conflict points near the intersection.

Table 4.5 – Crash Locations Ranked by Crash Severity

Rank	Street 1	Street 2	Total Crashes	Fatal	Injury	Class			PDO Crash	EPDO Rate
						A	B	C		
1	US 1 / Capital Blvd	S Main St / New Falls of Neuse Rd	77	0	20	0	5	15	57	225.0
2	US 1 / Capital Blvd	Wake Union Church Rd	28	0	11	1	3	7	17	177.5
3	US 1A / S Main St	NC 98 Bypass	36	0	16	0	8	8	20	154.4
4	Durham Rd	Wake Forest Market / Cloverleaf Park	20	0	8	1	4	3	12	147.3
5	US 1 / Capital Blvd	Jenkins Rd	26	0	13	0	2	11	13	122.2

Note: Crashes ranked by Equivalent Property Damage Only (EPDO) Rate, which represents a measure of severity. Data provided by NCDOT for crashes occurring 10/2005 through 9/2008.

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See Figure 4.5 – Crash Locations.

Table 4.6 – Crash Locations Ranked by Crash Frequency

Rank	Street 1	Street 2	Total Crashes	Top Crash Type	
				Type	Number
1	US 1 / Capital Blvd	S Main St / New Falls of Neuse Rd	77	Rear End, Slow or Stop	43
2	US 1A / S. Main St	NC 98 Bypass	36	Left Turn, Different Roadways	11
3	US 1A / S Main St	Ligon Mill Rd	30	Angle	14
5	US 1 / Capital Blvd	Wake Union Church Rd	28	Rear End, Slow or Stop	14
4	US 1 / Capital Blvd	Jenkins Rd	26	Rear End, Slow or Stop	11

Note: Crashes ranked by crash frequency. Data provided by NCDOT for crashes occurring 10/2005 through 9/2008.

Safety Watch List

Crash statistics show that two corridors have high crash frequencies at many intersections — South Main Street (between Capital Boulevard and Dr. Calvin Jones Highway) and on Capital Boulevard throughout the entire study area. A total of 8 intersections in a two-mile stretch on South Main Street have a pattern of crash occurrences, and 65 injuries were reported on South Main Street in the three-year analysis period. On Capital Boulevard, six intersections exhibited a pattern of crash occurrences, resulting in 59 injuries. On average, an injury occurs every two weeks at the intersection of South Main Street and Capital Boulevard.

On a positive note, three intersections topping the list of high crash locations in the *2003 Wake Forest Transportation Plan* showed a decrease in crashes per year in the most recent analysis period:

- US 1 at Burlington Mills Rd– decreased from 18 to 5 per year
- US 1 at Jenkins Rd / Stadium Dr– decreased from 25 to 8 per year
- US 1 at Purnell Rd / Harris Rd– decreased from 15 to 3 per year

High Priority Crash Locations

A preliminary review of the crash history was performed for the top five intersections based on the severity rankings. Field investigation and a review of planned projects were performed to confirm existing conditions, identify design features, and observe driver behavior. Field observations provided insight to potential patterns and revealed conditions that could be enhanced through geometric changes or enhancements to traffic control.

US 1 and South Main Street / New Falls of Neuse Road

Since the crash data was compiled for the *Wake Forest Transportation Plan Update*, this intersection was modified to include a longer eastbound left-turn lane on the approach to Capital Boulevard. Additional modifications should be considered that would lengthen the westbound right-turn lane. The majority of crashes were rear-end type collisions, some of which may be eliminated when a grade-separated interchange is built. The project is not funded at this time.

US 1 and Wake Union Church Road

The signalized intersection of US 1 and Wake Union Church sits less than a quarter mile north of the entrance/exit ramps to the US 1/Durham Road interchange. The prevalence of rear end collisions may be a factor of poor sight distance, excess speeds, and driver inattention. Improvements to this intersection likely will depend on decisions by the Wake Forest Town Board regarding the development of adjacent land. Ultimately, Wake Union Church Road may be extended over US 1 via a bridge that would connect with the northern extension of Ligon Mill Road.]

South Main Street and Dr. Calvin Jones Highway

This intersection is the first signalized intersection eastbound Dr. Calvin Jones Highway motorists approach after exiting Capital Boulevard. Motorists on Dr. Calvin Jones Highway are afforded offset left turn lanes to improve visibility when turning left. Heavy traffic volumes on South Main Street may contribute to an increase in crash occurrences. The signal timing should be analyzed to ensure adequate time for protected left turns from all approaches.

Durham Road and entrance to the Market of Wake Forest

The traffic signal heads at the intersection of Durham Road at the entrance to the Market of Wake Forest shopping center may be mistaken with signal heads for the nearby intersection of Durham Road at the southbound US 1 ramps. The resulting confusion of some motorists may lead to slower reaction times and crashes. Selective re-programming of the direction of signals may reduce driver confusion. Furthermore, a reduction in traffic volumes on Durham Road following completion of Dr. Calvin Jones Highway may reduce the crash frequency at this location.

US 1 and Jenkins Road

The signals and westbound approach to Capital Boulevard recently were modified. As a result, conditions should be monitored over time to assess any change in crash frequency. Another issue to monitor is the relatively high vehicle speed of southbound traffic approaching this intersection.

Future Travel Conditions

The challenges facing the future of the transportation network in Wake Forest are the collective result of sustained growth, continued reliance on the automobile for even short trips, and increasing competition for limited transportation funds. As mentioned in **Chapter 3**, various projections forecast substantial employment and population growth in Wake Forest over the next several decades. If this growth coupled with the recent surge of commuters in single-occupancy vehicles continues, few projects will do little to address deficiencies in the roadway network and gaps in the multimodal system.

The Triangle Regional Model mentioned previously was used to test the operation of the future roadway network. Population and employment projections prepared by each municipality in the Triangle were provided to the Capital Area Metropolitan Planning Organization (CAMPO) to forecast traffic in the horizon year. The resulting congestion is shown in **Figure 4.6**. A brief description of the Triangle Regional Model is presented in **Appendix B**.

As shown in **Table 4.7**, traffic can be evaluated based on a comparison of volume and capacity for individual roads. It also can be evaluated for parallel roads crossing an imaginary line called a "screenline". As shown in **Table 4.7**, five screenlines in the study area are listed; one each at the eastern, northern, western, and southern gateways to Wake Forest plus another in the middle of the town.

Some roads are forecast with vehicular volumes that exceed planned capacity, suggesting congested conditions will exist. In some instances, motorists may choose to exit the congested road and use an alternate route. For example, congestion on Capital Boulevard (US 1) south of Wake Forest may lead some motorists to exit on US 401 and then enter Wake Forest via Ligon Mill Road or Forestville Road. **Table 4.7** shows each screenline has sufficient planned roadway capacity to accommodate forecasted demand.

The Corridor Profiles presented in Appendix A provide additional information. Each corridor profile includes a photograph, information on traffic volumes, and relevant roadway characteristics. When feasible, the illustrative cross sections include bicycle and pedestrian amenities. Recommendations for the Wake Forest transportation system are presented in **Chapter 5**.

Table 4.7 – Future Volumes by Screenline					
Road	Existing 2007-2009		Future (2035)		
	No. Lanes	AADT	No Lanes	AADT	Capacity*
North-South Roads: south of Burlington Mills Road - Screenline "South Gateway"					
US 1	4	55,000	6	101,900	175,000
Falls of Neuse Rd	2	20,000	6	56,400	64,900
Ligon Mill Rd	2	7,900	2	15,900	25,900
Forestville Rd	2	5,800	4	21,200	41,400
East-West Roads: at eastern planning boundary - Screenline "East Gateway"					
NC 98	2	11,000**	2	48,500	51,800
Oak Grove Church Rd	2	920	2	7,700	17,300
Jones Dairy Rd	2	8,100	4	20,700	26,300
Rogers Rd	2	1,440	2	10,100	26,300
Burlington Mills Rd	2	2,800	4	23,700	51,800
North-South Roads: north of Purnell Road/Stadium Drive/North Avenue/Roosevelt Avenue/Wait Avenue - Screenline "Northside"					
US 1	4	34,000	4	31,100	26,600
Bud Smith Rd / Thompson Mill Rd	2	2,600	2	13,600	26,300
Jackson Rd	2	n/a	2	n/a	
Wall Rd	2	n/a	2	n/a	
N Main St	2	3,100	2	17,800	26,300
N White St	2	3,600	2	12,500	17,300
Gillcrest Farm Rd	2	n/a	2	n/a	
East-West Roads: west of US 1 (Capital Boulevard) - Screenline "Westside"					
NC 98	0	0	4	21,900	26,600
Purnell Rd / Harris Rd	2	4,500	2	8,900	26,300
Jenkins Rd / Stadium Dr	2	4,200	2	6,900	17,300
Durham Rd	3-5	17,000	4	22,100	17,300
New Falls of Neuse Rd	4	n/a	4	40,500	43,200
North-South Roads: south of NC 98 Bypass - Screenline "Southside"					
US 1	4	43,000	6	72,700	53,200
Ligon Mill Rd	0	n/a	4	21,400	34,700
S Main St	3	20,000	4	24,500	17,300
S Franklin St	0	n/a	4	11,800	42,840
Heritage Lake Rd	4	6,500**	4	15,900	34,700
Jones Dairy Rd	2	8,100	4	20,700	26,300

* Capacity for future conditions defined as Level of Service (LOS) D

** estimated by extrapolating 2007 PM peak hour turning movement counts to represent 24-hour ADT volumes

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See Figure 4.6 – 2035 Congested Corridors on previous page.

Complete Streets

The previous description of projects, programs and policies for each mode of transportation in Wake Forest can be encapsulated in a single interrelated map and policy for Complete Streets. **Figure 4.7** at the conclusion of this chapter shows existing and future complete streets identified during the planning process for the *Plan Update*. The following policy (presented verbatim) was adopted by the North Carolina Board of Transportation on July 9, 2009:

A. Definition

Complete Streets is North Carolina's approach to interdependent, multi-modal transportation networks that safely accommodate access and travel for all users.

B. Policy Statement

Transportation, quality of life, and economic development are all undeniably connected through well-planned, well-designed, and context sensitive transportation solutions. To NCDOT, the designations "well-planned", "well-designed" and "context-sensitive" imply that transportation is an integral part of a comprehensive network that safely supports the needs of the communities and the traveling public that are served.

The North Carolina Department of Transportation, in its role as stewards over the transportation infrastructure, is committed to:

- providing an efficient multi-modal transportation network in North Carolina such that the access, mobility, and safety needs of motorists, transit users, bicyclists, and pedestrians of all ages and abilities are safely accommodated;
- caring for the built and natural environments by promoting sustainable development practices that minimize impacts on natural resources, historic, businesses, residents, scenic and other community values, while also recognizing that transportation improvements have significant potential to contribute to local, regional, and statewide quality of life and economic development objectives;
- working in partnership with local government agencies, interest groups, and the public to plan, fund, design, construct, and manage complete street networks that sustain mobility while accommodating walking, biking, and transit opportunities safely.

This policy requires that NCDOT's planners and designers will consider and incorporate multimodal alternatives in the design and improvement of all appropriate transportation projects within a growth area of a town or city unless exceptional circumstances exist. Routine maintenance

projects maybe excluded from this requirement; if an appropriate source of funding is not available.

C. Purpose

This policy sets forth the protocol for the development of transportation networks that encourage non-vehicular travel without compromising the safety, efficiency, or function of the facility. The purpose of this policy is to guide existing decision-making and design processes to ensure that all users are routinely considered during the planning, design, construction, funding and operation of North Carolina's transportation network.

D. Scope and Applicability

This policy generally applies to facilities that exist in urban or suburban areas, however it does not necessarily exclude rural setting; and is viewed as a network that functions in an interdependent manner.

There are many factors that must be considered when defining the facility and the degree to which this policy applies, e.g., number of lanes, design speeds, intersection spacing, medians, curb parking, etc. Therefore, the applicability of this policy, as stated, should be construed as neither comprehensive nor conclusive. Each facility must be evaluated for proper applicability.

Notwithstanding the exceptions stated herein, all transportation facilities within a growth area of a town or city funded by or through NCDOT, and planned, designed, or constructed on state maintained facilities, must adhere to this policy.

E. Approach

It is the Department's commitment to collaborate with cities, towns, and communities to ensure pedestrian, bicycle, and transit options are included as an integral part of their total transportation vision. As a partner in the development and realization of their visions, the Department desires to assist localities, through the facilitation of long-range planning, to optimize connectivity, network interdependence, context sensitive options, and multimodal alternatives.

F. Related Policies

This policy builds on current practices and encourages creativity for considering and providing multi-modal options within transportation projects, while achieving safety and efficiency.

Specific procedural guidance includes:

- Bicycle Policy (adopted April 4, 1991)

- Highway Landscape Planting Policy (dated 6/10/88)
- Board of Transportation Resolution: Bicycling & Walking in North Carolina, A Critical Part of the Transportation System (adopted September 8, 2000)
- Guidelines for Planting within Highway Right-of-Way
- Bridge Policy (March 2000)
- Pedestrian Policy Guidelines –Sidewalk Location (Memo from Larry Goode, February 15, 1995)
- Pedestrian Policy Guidelines (effective October 1, 2000 w/Memo from Len Hill, September 28, 2000)
- NCDOT Context Sensitive Solutions Goals and Working Guidelines (created 9-23-02; updated 9-8-03)

G. Exceptions to Policy

It is the Department's expectation that suitable multimodal alternatives will be incorporated in all appropriate new and improved infrastructure projects. However, exceptions to this policy will be considered where exceptional circumstances that prohibit adherence to this policy exist. Such exceptions include, but are not limited to:

- facilities that prohibit specific users by law from using them,
- areas in which the population and employment densities or level of transit service around the facility does not justify the incorporation of multimodal alternatives,

It is the Department's expectation that suitable multimodal alternatives will be incorporated as appropriate in all new and improved infrastructure projects within a growth area of a town or city.

As exceptions to policy requests are unique in nature, each will be considered on a case-by-case basis. Each exception must be approved by the Chief Deputy Secretary.

Routine maintenance projects maybe excluded from this requirement; if an appropriate source of funding is not available.

H. Planning and Design Guidelines

The Department recognizes that a well-planned and designed transportation system that is responsive to its context and meets the needs of its users is the result of thoughtful planning. The Department further recognizes the need to provide planners, designers and decision-makers with a framework for evaluating and incorporating various design elements into the planning, design, and construction phases of its

transportation projects. To this end, a multi-disciplined team of stakeholders, including transportation professionals, interest groups, and others, as appropriate, will be assembled and charged with developing comprehensive planning and design guidelines to support this policy.

These guidelines will describe the project development process and incorporate transparency and accountability where it does not currently exist; describe how (from a planning and design perspective) pedestrians, bicyclists, transit, and motor vehicles will share roads safely; and provide special design elements and traffic management strategies to address unique circumstances.

An expected delivery date for planning and design guidelines will be set upon adoption of this policy.

I. Policy Distribution

It is the responsibility of all employees to comply with Departmental policies. Therefore, every business unit and appropriate private service provider will be required to maintain a complete set of these policies. The Department shall periodically update departmental guidance to ensure that an accurate and up-to-date information is maintained and housed in a policy management system.

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See Figure 4.7 – Complete Streets Plan.